

REMARKS

The Examiner is thanked for the thorough examination of this application. The Office Action, however, has continued to reject all pending claims 29-34 and 36-38.

35 U.S.C. 102(b) & 35 U.S.C. 103(a)

Claims 29, 31, 37-38 stand rejected under 35 U.S.C 102(b) as allegedly anticipated by or, in the alternative, under 35 U.S.C 103 (a) as obvious over Marrs (5,795,818). Applicant respectfully traverses the rejections made by the Examiner for the reasons discussed below.

Marrs discloses an integrated circuit chip to substrate interconnection and method. Specifically, referring to col. 10, lines 14-17, and Figs. 7, 8, Marrs teaches that the resulting bond 801 is a direct **gold to gold** connection between coined ball bond bump 312 on chip 201 and metallization 502 on substrate bonding contact 501C on substrate 501. In this teaching, it is taught or suggested to those skilled in the art that the coined ball bond bump 312 is **gold**. Moreover, referring to col. 10, lines 20-31 of Marrs, the passage “the resulting weld is not as susceptible to melting as solder” teaches or suggests that the coined ball bond bump 312 is NOT made by solder.

In contrast, each of the presently pending independent claims defines over these teachings. Specifically, independent claims 29 and 37-38 recite:

29. A solder bump for interconnection of flip chip devices comprising:
 - a semiconductor surface;
 - at least one contact pad over said semiconductor surface;
 - a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
 - an Under-Bump-Metallurgy (UBM) layer over said layer of passivation and said at least one contact pad, lateral dimension of the UBM layer being limited to be within lateral dimension of the at least one contact pad; and

at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

37. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said-semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad, lateral dimension of the UBM layer being limited to a size approximately the same as lateral dimension of the at least one contact pad; and

at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

38. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said-semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

Clearly, Marrs does not teach or suggest the claimed feature of “*at least one solder compound overlying the UBM layer*”.

Further, col. 10, lines 20-31 of Marrs states:

Several advantages result from the gold-to-gold or metal-to-metal bond 801 described above. First, gold is very ductile and malleable so it does not harden and crack. Also, the resulting weld is not as susceptible to melting as solder, which reflows at a relatively low temperature. This is a significant advantage over my U.S. Pat. No. 5,478,007 in which solder forms part of the electrical interconnection between the chip and substrate. Further, as described above, there is no need for applying solder flux and therefore no

added risk of corrosion of the aluminum bonding pads 204 and no need to clean off residual flux or inspect for residual flux.

Therefore, according to this express teaching away of Marrs, those skilled in the art would not be motivated to form the coined ball bond bump 312 as expressly claimed by each of the independent claims of the present application.

For at least this reason, Applicant respectfully submits that Marrs is legally deficient for the purpose of anticipating claims 29 and 37-38, because at least the features/limitations emphasized above are not taught or otherwise disclosed by Marrs. Likewise, as Marrs expressly teaches away from the claimed feature of “*solder compound overlying the UBM layer*,” the claimed embodiments would not be obvious over the teachings of Marrs. For at least these reasons, Applicants respectfully assert that the amended claims 29 and 37-38 are in condition for allowance.

As claim 31 is a dependent claim that incorporates the features/limitations of claim 29, Applicant respectfully asserts that this claim also is in condition for allowance. Likewise, as claims 30-34 and 36 are dependent claims that incorporate the features/limitations of claims 29, Applicant respectfully asserts that these claims also are in condition for allowance.

Comment on Finality of Office Action

The present Office Action was made FINAL on the grounds that Applicant’s previous amendments necessitated the new grounds of rejection. Applicant respectfully disagrees. In this regard, and taking claim 29 as a representative claim, Applicant’s previous amendment modified the last element of this claim as annotated below:

at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex

~~sidewalls before connecting to other components, wherein, and~~ the flat top surface is greater than the flat bottom surface before connecting to other components.

As is readily verified, the amendment made only a cosmetic change to the claim, by essentially just moving a phrase within the claim element. Clearly, this amendment does not import a substantive distinction, which would necessitate further searching. Importantly, the “at least one solder compound overlying the UBM layer” feature, which (among other features) distinguishes the claims over the newly cited Marrs reference, has always been in the claims. Accordingly, Applicant respectfully submits that the status of FINAL should be withdrawn from this present Office Action.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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